

JPRS-CST-91-007

25 MARCH 1991

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JPRS Report

Science & Technology

China

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Science & Technology China

JPRS-CST-91-007

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Update, Technical Details of Sino-Swedish FSW-1/Freja Satellite Launch Project

91FE0325A Beijing *SHIJIE DAODAN YU HANGTIAN*
[MISSILES & SPACECRAFT] in Chinese No 12,
Dec 90 pp 14-16

[Article by Guo Lin [6753 2651]]

[Text] In 1992, China's launch vehicle Long March 2C (CZ-2C, or LM-2C) will launch China's FSW-1 recoverable satellite and Sweden's FREJA scientific satellite simultaneously into their respective predetermined orbits. This paper describes the evolution of this project.

Historical Review

China and Sweden have reached an agreement to launch Sweden's FREJA satellite as a piggyback package on China's launch vehicle LM-2C from the Jiuquan Satellite Launch Center sometime between July and October 1992. Because FREJA is a complete satellite, this will be the first launch of two satellites on one launch vehicle. It is also China's initial entry into the international launch market following the formal signing of the first foreign satellite launch service contract in November 1987.

FREJA is a scientific satellite manufactured by the Swedish Space Corporation (SSC). This Swedish satellite is a follow-up to the first Swedish VIKING satellite.

The SSC is a state-managed corporation under the Swedish Ministry of Industry, responsible for the technical implementation of Sweden's national space program. SSC signed, as the primary contractor, the FREJA scientific satellite contract with the Swedish Board of Space Activities.

In 1985 the SSC began discussions with China on the possibilities for a piggyback launch, and also obtained a reservation for MAILSTAR, a low-orbit communications satellite, to be effected between January 1986 and October 1987.

In the summer of 1987 the MAILSTAR project was canceled because of insufficient funding, but SSC retained reservations, and began the research for the launch of the scientific satellite FREJA.

In 1988, in Beijing, China and Sweden reshaped the MAILSTAR launch contract into the FREJA satellite launch contract, and changed the launch period to Jul-Oct 1992.

The FREJA Satellite

FREJA is an open butterfly-shaped satellite, 2.2 meters in diameter, weighing 230 kilograms, and has a 2-year life expectancy. Installed on the satellite are two solid Thiokol motors, one Thiokol STAR-13A for perigee adjustment, and one Thiokol STAR-6B for apogee adjustment. The long axis of the satellite will be in line with the sun. A magnetic-torque unit determines the spin axle position. Its structure is made up of a central tube

with fixed instruments, and top-to-bottom platforms of solar cell panels. The FREJA will be put into a 599 to 1675 kilometer low-earth orbit with an inclination greater than or equal to 63 degrees. Installed on the satellite will be instruments for studying the aurora magnetic field, an energy particle detector, an electromagnetic-field and electromagnetic-wave testing assembly, and ultraviolet ray imaging instruments. This will be the first satellite to conduct a high-resolution survey of the upper ionospheric layer, and it is also the first research probe of the low-magnetic-belt phenomena in the upper ionosphere and auroral region. This is the primary aim of the SSC's launching of the FREJA satellite.

Compared with earlier satellites of this type, the FREJA has a higher digital communications transmission rate, an S-band downlink of 250-1000 kbit/s, and an uplink of 450 MHz; its power supply can carry a payload for sustained operations, and operate the downlink transponder.

The launch is set for 1992 at the peak of the solar activity cycle (11 years), whereas the 1986 launch of the VIKING was at the low level of solar activity; therefore from a space research point of view, the two projects are complementary.

The Link-Up and Separation of FREJA and LM-2C

To launch the FREJA, the builder of the LM-2C, the Beijing Wanyuan Industrial Corporation, made changes in the structure of the launch vehicle. Between the instrument bays of the main satellite and the launch vehicle, two cylindrical segments were inserted to double as the piggyback compartment (see figure 1), and the separation assembly.

The LM-2C will carry the Chinese-made recoverable satellite (the main satellite), and the piggyback satellite together into orbit. The satellite separation steps are depicted in figure 2: When the launch vehicle reaches the orbit entry point for the main satellite, the booster engine shuts down (see figure 2a);

Three seconds after booster shutdown, four separator explosive-bolt charges and the retro-rocket are fired. The main satellite and the launch vehicle [with piggyback compartment still attached] separate at a speed of 1.32 meters per second. (see figure 2b);

The rocket attitude-control system begins to adjust the launch vehicle's 2nd stage 1.5 seconds after separation. (see figure 2c);

About 120 seconds later, when the long axis is parallel with the main satellite orbit at perigee, at a precise point of reduced speed, the four bolt charges and two retro-rockets of the connected upper and lower segments of the piggyback compartment are fired, and the upper segment

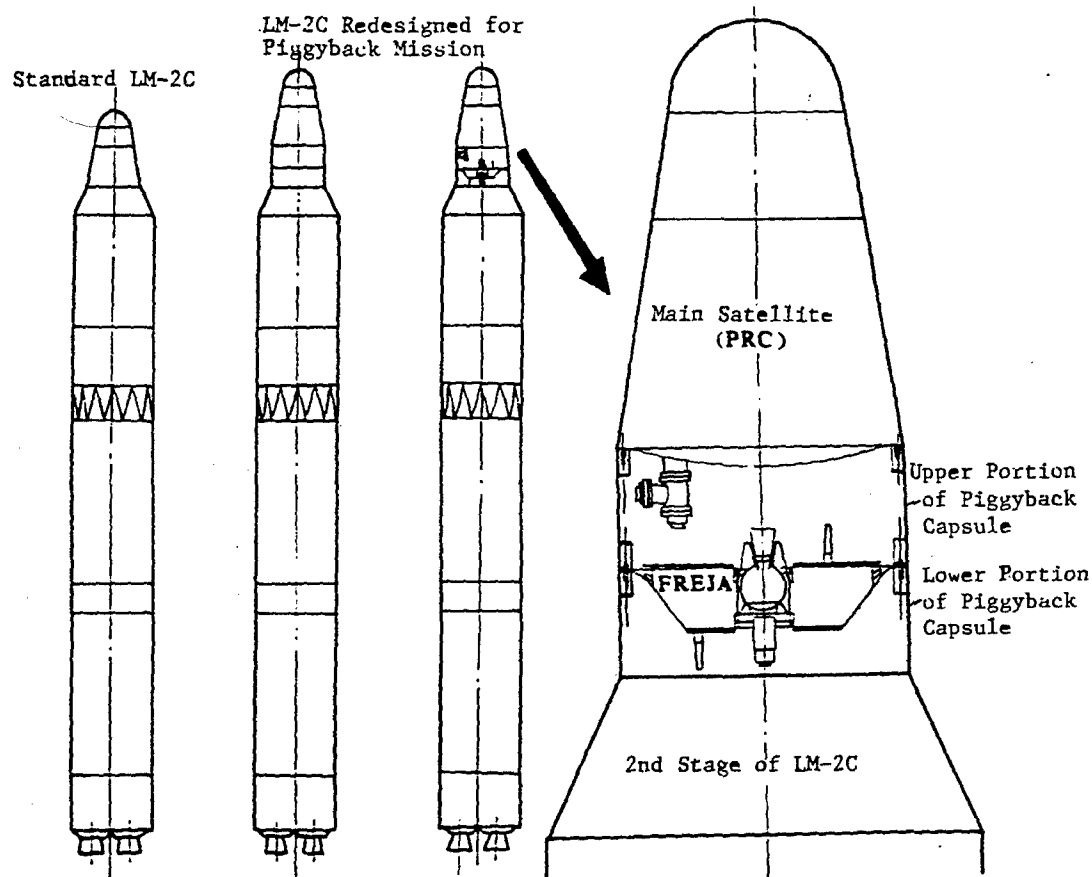


Figure 1. Interfacing of Swedish FREJA Satellite With LM-2C

separates forward as the launch vehicle's second stage moves aft, completing the rocket separation (see figures 2d and 2e).

Project Progress

Up to the present, the progress of the FREJA project has gone smoothly. As planned, the various tests of the satellite instruments are nearing the final stage. The instruments and miscellaneous parts that were developed and produced under European and American sub-contracts have already been delivered to SSC. From 10 March to 25 April 1990, the jointly appraised vibration

tests conducted at the Beijing Wanyuan Industrial Corporation were completed without a hitch. The Swedish and Chinese participants both expressed satisfaction with the results of the tests.

In November 1989, at Stockholm, Sweden, a satellite-rocket interface-control technology documentation coordination meeting was held, and the link-up control document was signed. In June 1990, at Beijing, the initial mission analysis critique was underway. In January 1991, another technical coordination meeting was held in Stockholm, and further revisions to the satellite and rocket link up control document were made.

Because there are some American-built instruments on the FREJA satellite, the SSC has now delivered to the U.S. State Department an application for an export permit to send the satellite to China.

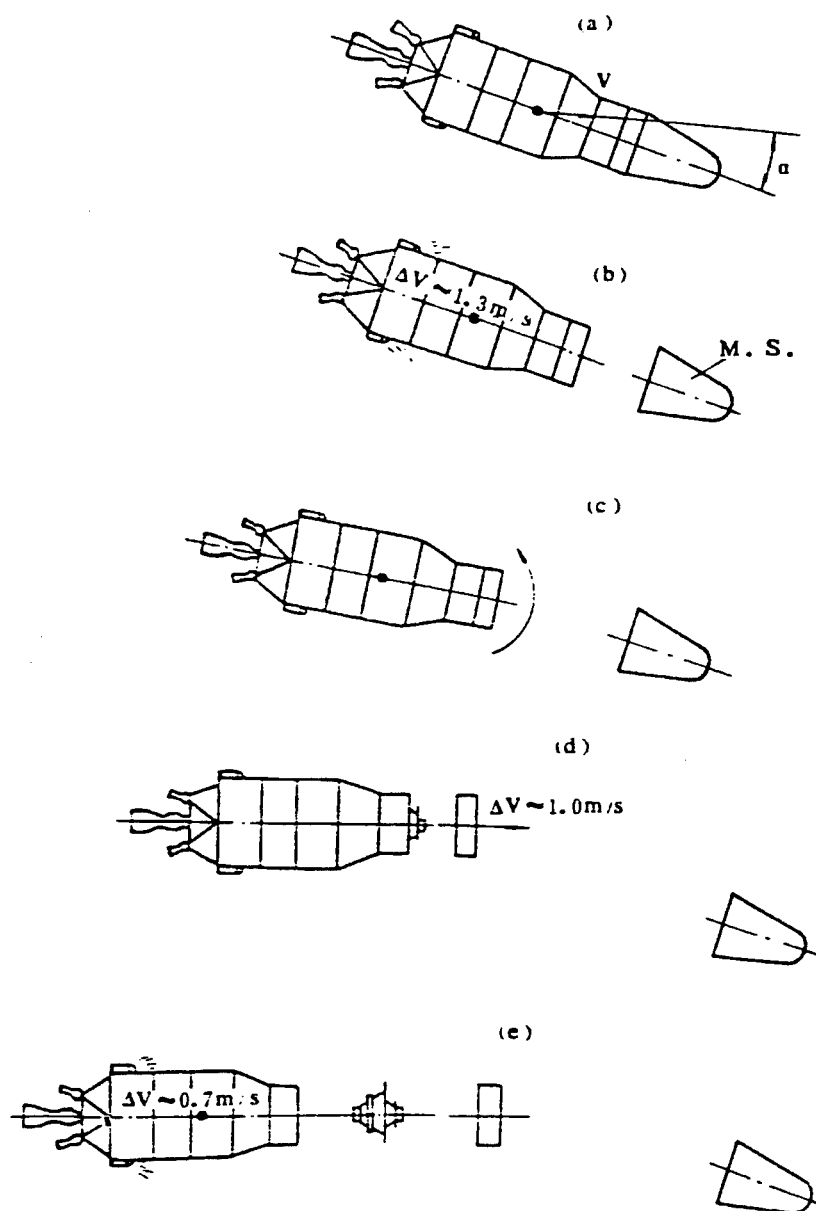


Figure 2. Satellite-Booster Separation Sequence. (a) Attitude at Main-Satellite Orbit-Entry Point; (b) Main-Satellite (MS) Separation; (c) Attitude Adjustment; (d) Separation of the Piggyback Segment; (e) Separation of the Swedish FREJA

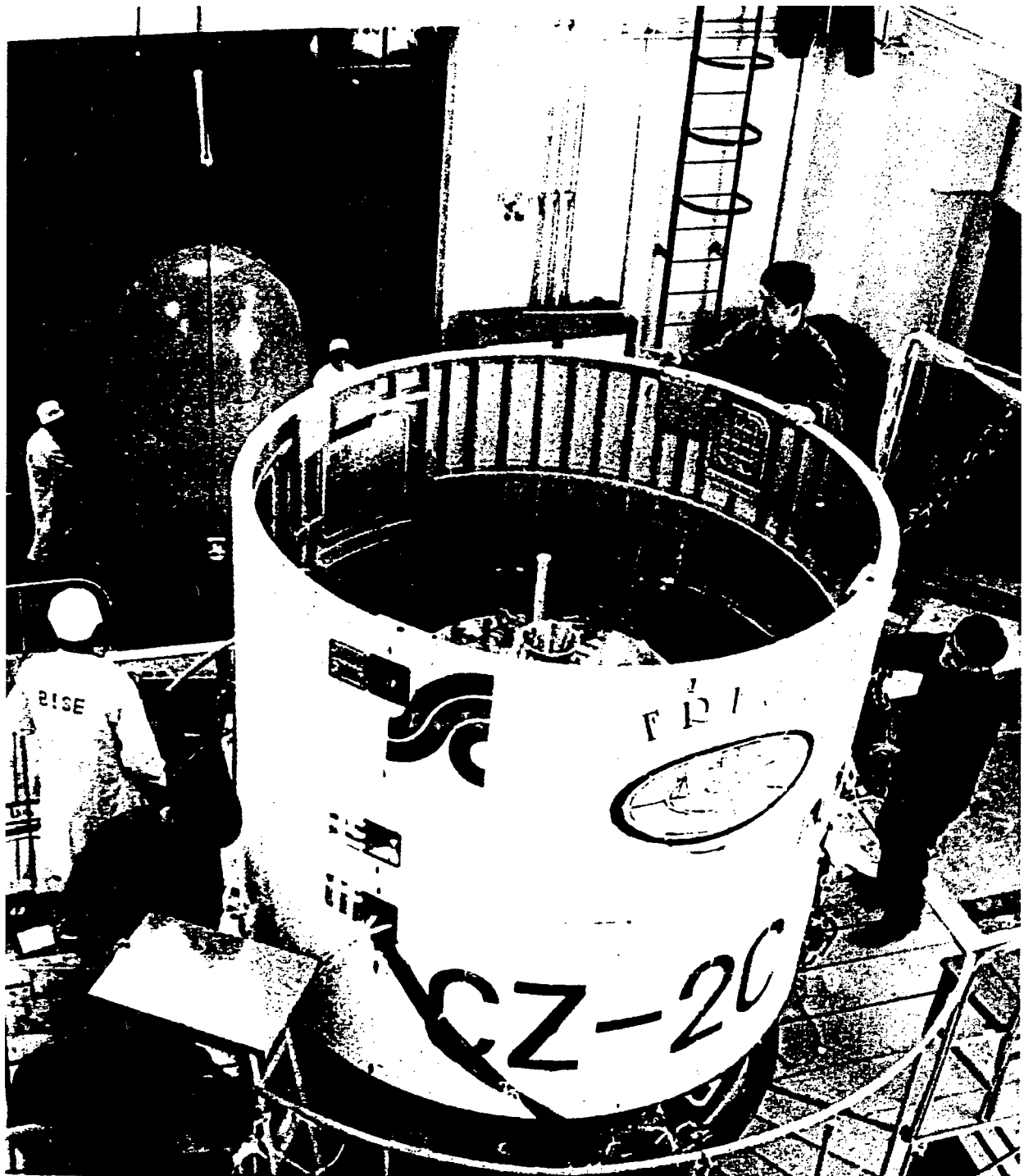


Figure 3. FREJA Satellite Compartment Shown With FSW-1 Fairing in Rear (Photo from front cover of SHIJIE DAODAN YU HANGTIAN, No 12, Dec 90)

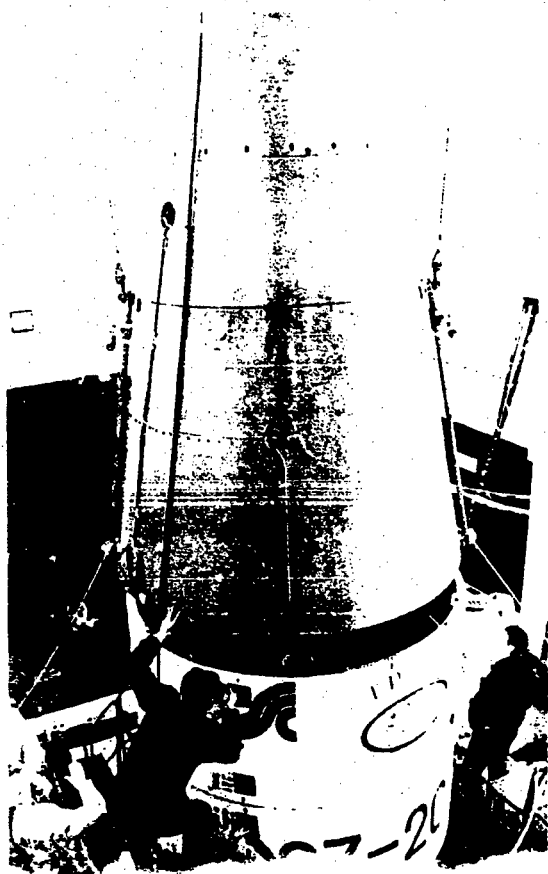


Figure 4. FREJA Satellite Fairing Being Mated to FSW-1 Fairing (left) and Undergoing Joint Vibration Testing (right). (Photographs from inside front cover of SHIJIE DAODAN YU HANGTIAN, No 12, Dec 90)

Activities of Chongqing Space Institute Highlighted

Introduction

91FE0143a Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 19 Sep 90 p 3

[Article by Chongqing Space Electromechanical Design Academy (CSEDA) Director Yan Kunlin [0917 1024 2651]]

[Text] In keeping with economic and S&T organizational reforms, CSEDA, a consolidated R&D academy with a full range of specialty departments composed of the five research institutes of the Sichuan Space Base, was approved by the Ministry of Aeronautics and Astronautics Industry in February 1988 for establishment in the Chongqing Shiqiaopu Scientific Research Zone.

The Academy, which primarily serves the Sichuan Space Base, handles production technology for national strategic weapons and launch vehicles, and R&D for tactical weapon systems; along with giving full charge to space

technology in filling its military products role, it supports local economic construction. Its purpose is to develop space technology, and build up local deficiencies through highly concentrated technology and manufacturing of high-tech products for economic and social good; its concentration of expertise in systems engineering and large-scale complex projects is especially high. It promotes the application of S&T in developing enterprises and solves the technical difficulties faced by local enterprises.

The Academy has taken advantage of its assembled force of space-technology advances, and combined machinery and electronics research to nourish a confident self-generating growth in the high-tech aspects of robotics, precision machines, control automation, and computers; through this it has made a genuine contribution to the technical advancement of enterprises, and the social and economic good. China's first industrial robot, "Tianlong-1", has distinguished itself on the No 2 Automotive Works production line. A glass-fiber facility designed and built to supplant imports, passed severe factory tests, and proved completely that it can compare favorably with similar facilities abroad; there is hope that the

long dependency of China's glass fiber facilities on imports can be turned around. A new type of armored car which was developed to alleviate the task of transporting securities has filled a need in China, and has caught the attention of foreign commercial interests as well. By applying its technical excellence in industrial automation, the Academy has erased the strain and anxiety that numerous factories had faced in repairing imported equipment, and it has demonstrated the virtues of space technologies in benefiting enterprises and the economy.

The Academy will continue to employ its special features and direct its high-tech research toward domestic deficiencies and the needs of society. It will emphasize development of industrial automation of production lines for domestic manufacture of items such as a double-helix modular light bulb, non-woven fabrics, shaped steel surfaces, and shock-absorbers; advance special and pivotal industrial technologies research, such as on-line survey technology for ultra-precision processing, methods and technical facilities for low-pressure casting, controlled deform welding and deform heat processing; reverse engineering and domestic production of imported high-efficiency manufacturing facilities and control systems, such as shuttleless looms, plastics machinery, steel-shaping machinery, and automotive electronics and electrical systems; developmental research on serialized a.c. frequency-conversion stepless speed governors; developmental research on prospecting radars for small ships; development of universal, multi-functional, and serialized robots and mechanical arms.

Strike in mid-stream, and hone for the struggle. Sidling into the course of reforms as it did, CSEDA knew full well the burden was heavy and the road was long. Having absorbed proud and capable talent and astronautical high technology, all beholden to the country and the people, there was a duty and obligation to do all that could be done for local economic construction, for the advancement of S&T, to make a personal contribution to the production might of the society, and for the grand and abiding endeavor of the Four Modernizations.

Commercial Products, Services

91FE0143b Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 19 Sep 90 p 3

[Article by Zhou Lifang [0719 5461 5364]: "Military Industrial Technology Drums Out Commercial Products in a Combo of Services for the Local Economy"]

[Text] CSEDA, supported by excellent military industrial technology and talent, developed a series of rather impressive commercial products, and in directing its developmental technology and technical services locally, it both extended and broadened its own self-development road, and served the local economy in accordance with the needs of the market.

Mechanization for Civilian Use Starts High, and Moves Fast

Using space technology as a backdrop for getting into the business of commercial products, CSEDA didn't focus on high efficiency and saturation of the home electrical products market, but rather searched for a piece of the market amenable to broad development, and took on mechanization of textiles, and fiberglass facilities for civilian use as the focus of development.

CSEDA has produced a steady stream of products: CJZ876G-190TSM flexible blade-shaft weaver, FA502 glass pellet spinning machine, A186D carding machine, and CQFA204 bulk carding machine. These machines are the most advanced products of their kind in the country. They have been critically examined against many similar foreign products, and analysis has shown that they are well designed, and have good performance. The FA502 glass pellet spinning machine, and the A186D carding machine are already in batch production, and they have won the Sichuan Fine New Products Award, and the Chongqing City New Products "Hundred Flowers" Award.

It is well known that there is a good international market for glass fibers, and the glass fiber industry is a lucrative business. There are many domestic glass fiber factories, but there is a long standing dependence on imports for those glass fiber facilities, and the costs are high; an imported glass fiber production line easily runs over 10 million U.S. dollars, and they are difficult to maintain. Imports must be replaced through national industrialization, and there are very favorable market prospects for doing so. CSEDA has thoroughly studied the market, and decided to design the key facilities for a glass fiber production line—a glass fiber drawing machine, and a non-twisting fly frame. Models are being tested at the Chongqing Glass Fiber Factory, and the quality indicators are completely on a par with those of the original foreign machines. In order to meet market needs, the products of these two national industrialized glass fiber facilities have already been put into batch production at only one-third of import prices, which doubtless is good news to China's glass fiber industry. At present, the glass fiber material that is now being produced at the Chongqing Glass Fiber Factory uses the STM-3 glass fiber drawing machine, and the STM-4 non-twisting fly frame.

The "Tianlong-1" Robot—a High-Tech Product

CSEDA's motive for product development was not only to fill gaps in the market in accordance with market needs, but also an awareness of its mission to employ its high technology and scientific research structure for the advancement of S&T and the development of society. The high-tech "Tianlong-1" industrial robot product is a crystallization of this mission. The "Tianlong-1" robot, which is fully electrically powered, multi-jointed, and user friendly, is primarily used for welding and cutting. At "China's First Robot Exhibition," visitors from the ministries, commissions, numerous factories, and from

all segments of society were impressed by the fact that "Tianlong-1" is composed entirely of Chinese-made parts, and gave high praise for its excellent slow-motion characteristics. Ten experts and professors from the State High-Tech Commission conducted their investigation, and judged the robot a success, and ready for use in test production. The robot's primary technical laboratory performance indicators place it near or on a level with early 1980's world standards for similar products, and they meet the target requirements of the Seventh 5-Year Plan; with further modifications and production testing, these robots can be put into small-batch production.

Unlike other domestic robots which are still in the laboratory stage, "Tianlong-1" has already been in use for some time. It was first used for welding the cab floor of the CA141 Liberation vehicle at the No 1 Automotive Works. At the No 1 plant, "Tianlong-1" was said to be logical in design, user friendly, understandable at a glance, and to have a reliable welding system; it was ready to leave the laboratory, and could go on to the factory for tests. Then the "Tianlong-1" went again to the No 2 plant where it entered a solitary welding position in the vehicle body shop cab-floor assembly line. The welding shop environment is very poor; it frequently has more than 130 welders in action; the temperature in summer gets up to 45 degrees Celsius; labor intensity is high, and robots must be used to replace manual laborers. The "Tianlong-1" has undergone every test, and its welding quality surpasses that required of human welders. It earned high praise for this at the No 2 plant, and there is every reason to think that the use of Chinese-made robots should be expanded. From May to mid-August 1989, "Tianlong-1", in working a normal 800 hours at the No 2 plant, welded 3,020 cab floors, making 140,960 welds. All of the products welded by "Tianlong-1" met required quality standards, and were installed on "Dongfeng" vehicles that were sold to customers. In its application, "Tianlong-1" has demonstrated its usefulness and potential value to the automobile industry.

In April of this year, experts and learned members of the National High-Tech Promotion Review And Assessment Committee organized by the State Science and Technology Commission, expressed resounding praise for the "Tianlong-1" and its Chinese-made parts, its durability, reliability, low cost, and its first place status among Chinese-made robots.

Safe, Reliable Security Vehicles, and Luxury Auto Electronics and Electrical Products

Every day large amounts of money are spent for cleverly disguised, seemingly ordinary vehicles, for cash shipments to various points of the financial network dispersed down avenues and alleys—for delivery of the lifeblood of the people's daily economic livelihood. The safety of this form of transportation requires a high degree of security, and alertness, but at times, although

care is taken, robberies do occur. Faced with this situation, security units have wanted a highly safe, strong, low-risk security transport vehicle. CSEDA produced the DYQ5020XXCA security vehicle for this purpose. This vehicle has a special security vault that is fire-proof, has crime prevention capabilities, and an electronic cipher lock. The vehicle is equipped with a trip control system, micromotor controls that operate engine ignition codes, and has theft prevention, emergency, and extended alarm capabilities. The vehicle has been appraised and accepted by MAAI; it is gaining wide attention on many fronts, and has aroused considerable foreign commercial interest.

CSEDA has developed many "brief, smooth, and quick" automotive electronic and electrical products: alcohol-sensitive control devices, fuel flow-volume indicators, engine modular load-control devices, darkness-sensitive automatic light-control devices, engine failure diagnostics system, automatic performance check and failure-light alarm instruments, engine load governors, and anti-shock ignition booster units.

In April of this year the Academy designed and manufactured an 11KVA, 22KVA ac electric-machine converter that passed many measurement checks, a 200-hour test run, and on-site factory tests; the technical indicators matched those of the Japanese SANKEN SVF product series. This product is ready to enter the design-finalization and manufacturing stage. A domestically made ac generator converter was manufactured that can help turn around the backwardness of electric power transmission in China by saving energy, and raising production strength.

Helping Industry Maintain Imported Facilities

It is said that production lines imported in the early and mid 1980s are now in a peak maintenance period; the breakdown rate is high, making it difficult to sustain normal operations. This is affecting production, and causing anxiety in industry. Most of these breakdowns in imported facilities are occurring in the control mechanisms, and this is precisely the technological weak link for many industries. CSEDA as a unified machinery and electronics research organization, is fairly strong in the field of industrial automation, and has a wealth of experience in maintenance of imported facilities. The Academy rescued the Weihai Chemical Fiber Factory and the Chengdu Cotton Mill from the angst over the production paralysis caused by breakdowns of their imported chemical-fiber facilities and imported blade-shaft weavers.

In February of this year, the Academy undertook the repair of a key component of the No 14 Plastics Factory's 1.2-million-(yuan) imported plastic products production line—the plastic form press. After this equipment was imported in 1984, its cumulative time of normal operations did not add up to 1 full year; the efficiency rate of its semi-operational status was only 44.3 percent, which caused great economic losses. In only 3 days the

Academy found and corrected the electronic device failure, which was the result of irrational design, and poor operational procedure. The equipment was restored to normal operations, achieved an efficiency rate of 100 percent, and reduced costs by 50 percent. The Academy solved the problem that had plagued the factory for many years, and resuscitated the doomed enterprise. The Chongqing No 5 and No 6 plastics factories were also experiencing high breakdown rates with their imported facilities, and couldn't eradicate their problems. They sought assistance from the Academy. The facilities were satisfactorily restored, and given new life.

CSEDA, through profound technology and excellent service, is winning ever greater confidence, and outstanding success.

Improved Management

91FE0143c Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 19 Sep 90 p 3

[Article by Fan Guirong [2868 6311 2837]: "Strengthen Management, Promote Scientific Research"]

[Text] CSEDA, in a few short years, has worked hard, strengthened management, broken ground and moved forward, and is bravely innovative. With a fast rhythm and high efficiency as its work style, and producing results and talent as its purpose, it set up a proper management model and organization system, and as it built a central-city scientific research academy into a large self-run production base, it opened up outlets for selling needed commercial products. It developed a Sichuan space industries production base, and contributed to local economic construction. The methods it employs are:

Set up a high efficiency management organization. In management organization and personnel structure, small is paramount. The main elements of the management organization are: a science and technology department, a quality control department, and an information department. The complement of management personnel is kept within 10 percent. Basic scientific research, production, planning, materials, instruments, resources, and files are all controlled by the science and technology department. Design responsibility is implemented by the technical director system. General designers are fully responsible for research manufacturing, and they handle both administrative and technical aspects. The administrative director system, and technical director system are placed under the leadership of the Academy president. They work in close cooperation, and guarantee unimpeded channels.

Planning is foremost, systematic, and delegated effectively. Planning is thoroughly managed in all aspects, there is lateral contact, mutual assistance, and emphasis on main points and procedures. Realistic and rational consolidated annual and seasonal plans are worked up. When the plans are disseminated, each line and item are

implemented at the various levels down to the appropriate unit or individual. The planning department, at the appropriate time, shepherds each task through its operations and problems. Planning is managed in strict accordance with the arranged system. In recent years, the Academy took on responsibilities, completed schedules, and delivered, and earned plaudits from higher levels and cooperating elements.

Raise quality awareness. Grasp quality control. Good and bad quality of products results from the quality of planning. Therefore, the Academy took a hard look at quality control and the quality awareness training of technicians. A control department was set up with special responsibilities for quality, and under it a cost-engineering office, a reliability office, a quality control office, and a standardization office were set up to take on design quality, and to advance all-around controls and checks. Premier Zhou Enlai's rule for research and manufacturing of military products was "Be genuinely conscientious, careful and meticulous, safe and reliable, and surefire." In applying these principles to civilian products a complete system of quality control rules and regulations was set up. Quality and reliability in planning are guaranteed.

Study the market closely. Grasp information research. In a commercial products society, information is an important commodity. When the Academy was established it proceeded directly to set up an information force. An information department was established, and under that a business-strategy research office was set up to study national macroeconomic policy information, and a research office was set up to gather information on market needs and conditions. The information department studied plans for national and industrial development, policy, market situations, and status of products, supplied timely and reliable information, reported on the feasibility of bringing out products, proposed and supplied background information to leaders for policy decisions, and increased the vitality of products.

To manage talent, bring in a competitive system. A win-or-lose employment system was instituted. When the Academy was just established, it clearly stipulated that everyone coming to work at the Academy would be on probation for 1 year. If they made the grade, they would be brought into the employment system. Once hired, there would be a half-year check, and a formal annual written examination. After verification by the local unit and the Academy personnel affairs department, they would be judged by the Academy director's organization to decide their employment status. The merits of the employment period are recorded in the personnel file, and it becomes the basis for raises, promotions, and dismissals. These methods have strengthened the operational zeal of the scientific research personnel, their sense of responsibility, and competitive conscientiousness.

Implement a task (mission) contract system. The Academy has implemented a contract system for all of its

tasks, and adheres to a principle of "budgetary responsibility, guaranteeing of quality, rewarding of frugality, and fining of wastefulness". Allocations are made according to responsibility, rights, and profits. General designers (office chiefs) have collective control of personnel, finances, and materials. There are three kinds of contracts: full contracts, fixed-quota assignments, and parceled assignments. Fixed-quota assignments are applied to tasks that cannot be measured by economic profits. Full-period tasks are divided into assignments according to the stages of design manufacture. Major engineering projects are let in parceled assignments according to the nature of the work involved. All Academy personnel who complete directed tasks ahead of schedule will be allowed to organize their own tasks. In addition to the routine procedure for granting awards for technical advancements, the Academy may grant other awards for technical advancements, economic profits realized, and for those who finish tasks ahead of schedule. There are special awards for those who independently make breakthroughs into difficult technological problems.

Although the above actions have been taken in the management of the Academy's scientific research, there still are improvements to be made, and the search for a more suitable Academy management model and organization system will continue.

CSEDA Organizational Structure

91FE0143d Beijing KEJI RIBAI [SCIENCE AND TECHNOLOGY DAILY] in Chinese 19 Sep 90 p 3

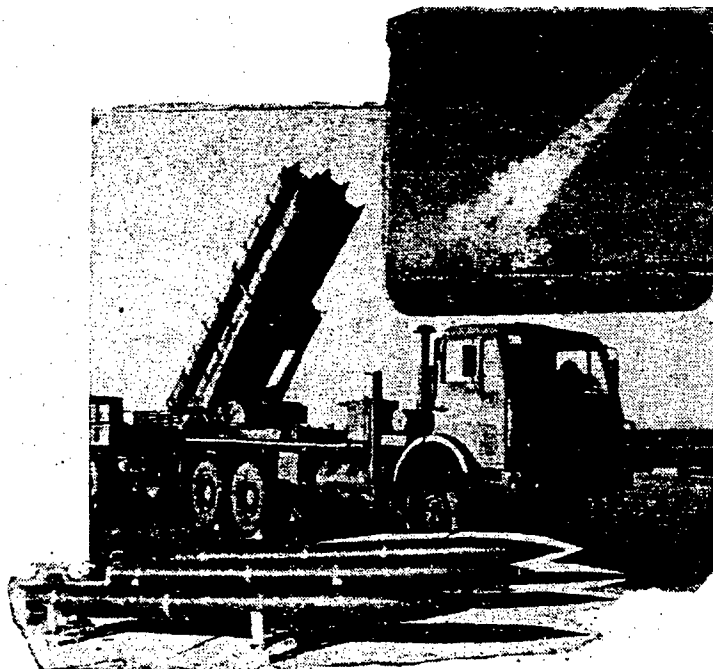
[Article by Zhang Wenqi [1728 2429 2630]]

[Text] **Academy organizational structure:** Academy Office, Party Committee Office, Information Depart-

ment, Science and Technology Department (includes a Planning Assignment Office, Instruments Office, Consolidated Planning Office, Intelligence Records Office, Materials Office), Finance Office, Labor Affairs Office, Political Office.

Quality Control Organization: Quality Control Department (includes a Quality Control Management Office, Cost Engineering Research Office, Reliability Research Office, Standardization Office.

Scientific Research Organization: Tactical Rockets Research Laboratory (with five research labs); Precision Machinery Research Laboratory (includes a General R&D Office, Mechanical Structure Design Office, Automatic Control Research Office, Measurement Testing Research Office), primarily engaged in precision machinery and automatic-control production line R&D; Strategic Weapons Design Office; Radar Research Office; Industrial Robots Research Office, primarily engaged in industrial robots and mechanical-arms R&D; Automation Research Office, primarily engaged in the research manufacture of industrial process-control automation and electronics products; Electronics and Electrical Devices Research Office, primarily engaged in research manufacture of automatic-control and vehicle electronics and electrical devices; Special-Use Vehicle Design Office, primarily engaged in vehicle reconstruction and vehicle parts design; Computer Applications Development Research Office, primarily engaged in scientific computation, CAD/CAM, and office automation development research; Technology R&D Office, primarily engaged in industrial production line design, and new technology research; S&T Development Corporation; Testing Factory.



Tactical Missile Weapons System Designed by the Academy

**Microwave Tubes, Millimeter-Wave Devices,
Lasers, Other Achievements of MMEI's Institute
12 Accredited**

91P60125 Beijing ZHONGGUO DIANZI BAO [CHINA
ELECTRONICS NEWS] in Chinese 8 Feb 91 p 3

[Article by Tian Ying [3944 5391]: "17 Projects of
MMEI's Institute 12 Pass Appraisal"]

[Summary] The scientific research results in 17 projects undertaken by MMEI's Research Institute 12 recently passed ministry-level technical appraisal. These 17 projects are: a 2-cm-band CW coupled-cavity traveling wave tube (TWT), a 3-cm-wavelength high-power 50-nanosecond-pulse magnetron, a 5-cm-wavelength oscillating-frequency-locked magnetron, a VE hydrogen-filled thyatron, a gem-metal sealing apparatus, an LSI ASIC for a scanning electron microscope, an ultrasonic

machining apparatus for a composite-material non-capture grid and multimode-gun graphite grid, a series of SHN-type helium-hydrogen laser medical instruments, a solid-state spectral-line twin-beam-output total-internal-[reflection]-cavity CO₂ laser, an ultraviolet photodiode, research on design of and program library for a grid-controlled TWT, research on broadband high-gain technology for a forward-wave amplifier tube, an 8-mm-band pulse peak-power detector, new millimeter-wave transmission lines and transmission systems, research on improving microwave-tube cathode life and emitter uniformity, and a DD2.5 deuterium lamp. At the formal appraisal, the 50-plus technical experts from MMEI, various electronics research institutes, and the Commission of Science, Technology & Industry for National Defense commented that these results—some of which meet eighties international standards—will greatly facilitate defense modernization and aid the economy.

**Chinese Scientist Doing Research in Italy
Announces World-Record Conductivity for
Lithium Polymer**

91P60120 Beijing GUANGMING RIBAO in Chinese
31 Jan 91 p 4

[Article by Mu Fangshun [4476 2455 7311]: "Chinese
Visiting Scholar Wang Gang in Italy Achieves Important
Research Results"]

[Summary] Rome, 29 Jan—While studying conducting
polymers at an Italian national research center, Chinese
visiting scholar Wang Gang [3769 0474] from the CAS
Institute of Physics made a significant breakthrough—
the development of a thin-film Li-ion solid-state

polymer with a room-temperature (20°C) conductivity of
 $3 \times 10^{-3} \text{ (ohm-cm)}^{-1}$, the highest value reached to date for
this material in the world. Conventional ion conducting
polymers have a room-temperature conductivity of 10^{-7}
 (ohm-cm)^{-1} , and will provide sufficient current for oper-
ating an all-solid-state chargeable electrolytic battery
only when the temperature is raised to 80-120°C; there-
fore scientists for years have been trying to develop an
ion conducting polymer with sufficient room-
temperature conductivity to be incorporated into a bat-
tery designed to work at room temperature, as Prof.
Wang has done. The Italian scientists at the research
center commented that Prof. Wang's discovery will be of
great significance for solid-state-ion studies, electro-
chemistry, and new materials.

Inhibition of Human Immunodeficiency Virus Reverse Transcriptase in Vitro by Extracts of Chinese Medicinal Herbs

40091007A Beijing ZHONGGUO YIXUE KEXUEYUAN XUEBAO [ACTA ACADEMIAE MEDICINAE SINICA] in Chinese Vol 12 No 6, Dec 90 pp 391-395

[English abstract of article by Tang Xiaoshan [0781 1420 1472], Chen Hongshan [7115 7703 3790], et al., of the Institute of Medicinal Biotechnology, Beijing]

[Text] Thirty-three Chinese medicinal herbs reputed by ancient Chinese folklore to have anti-infective properties were extracted. The extracts and their compounds were tested for inhibitory activity against the human immunodeficiency virus reverse transcriptase (RT) in vitro. Eight of the 33 extracts were found to be active. Of these, MBA.A.9045 was studied in greater depth. We found that it was a noncompetitive inhibitor against HIV-RT. The concentration of MBA.A.9045 reducing HIV-RT activity by 50 percent (IC_{50}) was 22 μ mol/L. Chinese medicinal herbs appear to be a rich source of potentially useful materials for the treatment of human immunodeficiency virus infection.

A Cytological Study of Chromosomal Structure Changes in a Common Wheat Variety, Xiaoyan No. 6

40091007B Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 17 No 6, Dec 90 pp 430-437

[English abstract of article by Li Wanlong [2621 8001 7127], Li Zhensheng [2621 2182 5116], and Mu Sumei [4476 4790 2734] of the Northwestern Institute of Botany, Yangling, Shanxi]

[Text] In this paper, a cytological study was reported on the chromosomal structure changes in a superior variety of *Triticum aestivum* L., Xiaoyan No. 6. Both Xiaoyan No. 6 and its related varieties were crossed with Chinese Spring (CS), and the data of chromosome pairing of the F_1 hybrids showed that great differences existed between the chromosomal structure of Xiaoyan No. 6 and that of CS. In the F_1 hybrids between octoploid *Agrotriticum* Xiaoyan 693 and wheat varieties Xiaoyan No. 6 and Xiaoyan 96, the chromosome configuration $19'' + 2''' + 5'$ was observed, which indicated the presence of at least two *Agropyron* chromosome segments in each of these two varieties. Among the F_1 hybrids of (CS ditelocentrics x Xiaoyan No. 6) F_1 two things were found. One, the pairing frequencies of telocentric chromosomes 1AL, 2AS, 5AS, 6AS, and 7BS were lower than the C value (90.1 percent) of (Cs x Xiaoyan No. 6) F_1 significantly at 1 percent level, which confined the two alien segments within these five chromosome arms. Two, the telocentric chromosomes of 1AL, 2DS, 4DS, 6AL and that of 3B($t''S + t'L$) participated in or related to the formation of multivalents in the F_1 hybrids. Therefore it could be concluded that there would be at least two reciprocal

interchanges present in Xiaoyan No. 6. The chromosomes involved in it were 1A, 2D, 3B, 4D, and 6A. The origin and identification of the alien translocations were also discussed.

Characters of the Regenerated Plants and Their Progenies (R_2) From Rice Protoplasts

40091007C Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 17 No 6, Dec 90 pp 438-442

[English abstract of article by She Jianming [0152 1696 2494], Zhou Hanyang [0719 6714 2254], et al., of the Institute of Agrobiological Genetics and Physiology, Jiangsu Academy of Agricultural Sciences, Nanjing, Li Xianghui [2621 0686 6540] and Sun Yongru [1327 0516 1172] of the Institute of Genetics, Academy Sinica, Beijing]

[Text] A total number of 206 regenerated plants (R_2) of six plant lines of rice strain 77-170 from protoplasts were obtained. Ninety-six plants out of them were observed their the genetic character and chromosome number. [sentence as published] The variation of characters was shown in the height of plant, length of flag leaf and main panicle, number of effective panicles and grains per panicle, fertility and growth duration of the regeneration plants (R_2). Except the plant height, all of characters were unstable in R_2 . The chromosome number was 24 ($2n = 24$). Fifty-six plants out of them were tested with isozyme. The isozyme zymograms of esterase and peroxidase of seeds of the regenerated plants (R_2) were similar to those of the control plants.

The Construction of Genomic Library of Wild Soybean

40091007D Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 17 No 6, Dec 90 pp 455-460

[English abstract of article by Cheng Yuzhong [4453 3768 1813] and Mi Jingjiu [4717 2529 0046] of the College of Biological Science, Beijing Agricultural University]

[Text] Bacteriophage Lambda EMBL4 was purified by density gradient centrifugation in cesium chloride. Vector DNA was prepared by double digestion of purified EMBL4 DNA with BAM HI/SalI. High molecular weight wild soybean DNA was extracted by CTAB method and was partially digested with Sau3A. The wild soybean insert DNA fragments ranging from 10 to 22 kb were recovered from agarose gel and joined with the EMBL4 vectors. The resulting recombinant DNA was packaged in vitro, and 8×10^6 pfu were obtained. This is completely met with the theoretical value required for wild soybean genomic library. The library was screened by using α' -cDNA of cultivated soybean storage protein as a probe and one positive clone was obtained.

Dependence of recA Gene for the Replication of Chromosome of Escherichia Coli Initiated by the Integrated Mini-F Plasmid Carrying IS1 Sequence

40091007F Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 17 No 6, Dec 90 pp 476-483

[English abstract of article by Mao Yumin [3029 5940 3046] and Sheng Zujia [4141 4371 0857] of the Institute of Genetics, Fudan University, Shanghai. The subject is supported by the National Natural Science Foundation of China (3870279).]

[Text] We have reported the dependence of recA gene for the replication of chromosome of E. coli initiated by the F' plasmid but not the F plasmid. Mini-F plasmids with IS1 sequence and origin of replication from F and F' plasmid have been constructed. Twenty percent of the integrative suppression strains of these mini-F plasmids were found to be recA dependent, irrespective of the origin of replication (F or F' plasmid) and the direction of replication (uni- or bidirectional). The reported experimental results tend to suggest that the site of integration is of primary importance in the dependence vs. independence of recA gene for the replication of the chromosome initiated by the integrated plasmid.

Isolation and Mapping of Arbitrary Single Copy DNA Fragment Located on Human Chromosome 11p11-q11

40091007E Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese Vol 17 No 6, Dec 90 pp 469-475

[English abstract of article by Xu Yun [1776 5366], Xue Jinglun [5641 0079 0243], et al., of the Institute of Genetics, Fudan University, Shanghai]

[Text] A library of genomic DNA has been constructed in EMBL3 lambda phage, from a Chinese hamster/human lymphocytes somatic cell hybrid carrying human

chromosome 11 and 20. Recombinants containing human genomic DNA origin can be isolated from the hybrid cell genomic library by using species-specific probe. Eight single copy fragments have been isolated from 13 recombinants. One of them designated as FD11-1 has been identified on chromosome 11 by hybridized it with hybrid cell clone panel and mapped on chromosome 11p11-q11 by chromosome in situ hybridization. [sentence as published] On chromosome 11, three linkage groups were reported, which located on 11p15, 11p13 and 11q13 respectively. Therefore, the FD11-1 will supply a new locus on chromosome 11 for linkage analysis. Endonuclease recognizing sites and potential recognizing sites on FD11-1 will guide the further RFLP studies.

Genetic Analysis of the Host Range of the Plasmid RSF1010

40091007G Beijing WEISHENGWU XUEBAO [ACTA MICROBIOLOGICA SINICA] in Chinese Vol 30 No 6, Dec 90 pp 422-427

[English abstract of article by Sun Xinian [1327 3556 1628] of the Department of Biology, Liaoning University, Shenyang]

[Text] Thirty-two host range mutants of pMO58, which contains an 8.0 kb fragment of RSF1010, were screened, using the transposon Tn5 insertion mutagenesis. To judge the genes which affect the host range of plasmid, the Tn5 insertion sites were located with restriction endonuclease mapping. The ability of the plasmid replication in different recipients was checked with DNA transformation.

The results further confirmed the barrier to the host range of plasmid was their inability to replicate and maintain themselves in genetically different host. The repA, repB and repC genes were necessary for the plasmid replication, but the repC gene may be a positive regulator and its function may be complemented by host gene products.

New AI, Expert Systems Developed**Interpreter for Seismic Prospecting Data**

91FE0187A Beijing JISUANJI SHIJIE [CHINA
COMPUTERWORLD] in Chinese No 43, 7 Nov 90 p 1

[Article by Liu Jiuru [0491 0046 1172]: "Artificial Intelligence Used for Automatic Interpretation of Seismic Prospecting Data"]

[Text] The SESES seismic prospecting data interpretation system, a key state project of the Seventh 5-Year Plan and one of the eight key research topics of the 1989 state 863 Program, recently passed its expert evaluation, marking a new breakthrough in China's use of artificial intelligence (AI) to interpret and analyze seismic prospecting data.

Seismic prospecting is a major method of prospecting for petroleum and natural gas. Since the 1980's, all of China's field seismic prospecting data have been processed by computer, but the large body of resulting seismic profiles still must be analyzed by human interpreters; thus, with a steady increase in the number of prospecting tasks, manual interpretation has become a bottleneck. The [SESES] seismic prospecting data expert system, jointly developed by the CAS Computing Institute and the Petroleum and Natural Gas Corporation's Physical Exploration Office, has successfully performed automatic interpretation of seismic prospecting data, thus eliminating this bottleneck.

The SESES system consists of three expert systems. 1. The SIS seismic profile geological structure interpretation system, which is the centerpiece of the SESES system, interprets the geological structure that is embodied in the seismic profiles. Starting from a body of profile data for a survey area and initial positional information on the stratigraphic units in the area, it automatically recognizes coherent line-ups, traces the position and strike of each stratigraphic unit that is of interest in the survey area, and recognizes and interprets certain complex geological phenomena within the stratigraphic units, including faults and composite wave groups. 2. The SEFLES seismic-profile fault-linking expert system uses the stratigraphic interpretation information output by the SIS system to link fault points, identifying the faults in each stratigraphic unit [in a succession of profiles] that are geologically the same fault, and outputs this information as an appropriate data structure. 3. The CIES closing interpretation expert system is a diagnostic system that determines whether the profile interpretation is correct and whether all of the profile interpretations are consistent. Selection and operation of the three systems is mouse-driven.

The Physical Prospecting Office of the Petroleum and Natural Gas Corporation has developed the GRI 2DI man-machine interface interpretation workstation on a

Sun 3/280 computer; when SESES is run on this workstation, the expert system is integrated with the main-machine interface. The system design is efficient and practical and is technologically on a par with the world state-of-the-art.

First Domestic General-Purpose Knowledge-Based System

91FE0187B Beijing JISUANJI SHIJIE [CHINA
COMPUTERWORLD] in Chinese No 43, 7 Nov 90 p 2

Article by Li Daxue [2621 1129 1331]: "First General-Purpose Knowledge-Based System Is Created at Fudan University"]

[Text] Until now, no mature commercial knowledge-based system has appeared anywhere in the world, but all countries, and especially the developed countries, are stepping up their efforts to develop such systems amid much fanfare. The KBase general-purpose knowledge-based system, developed by Fudan University's Computer Sciences Department under the organizational supervision of the Ministry of Machine-Building & Electronics Industry (MMEI), has made breakthrough progress and has recently passed ministry-level evaluations at Shanghai. Dozens of experts and professors from MMEI and from the relevant advanced schools and computer research units in Shanghai all agreed that the system is technologically advanced and has an efficient architecture. Its appearance constitutes a first in China, and the main technologies involved are already at the international state-of-the-art.

The KBASE system combines AI conceptions and database technology for effective storage and management of large bodies of formatted data and large amounts of compiled rules. The system was established with the support of the INGRES relational database management system on a MicroVAX II/VMS computer. The system includes the main functions of the LDL knowledge base system announced by the MCC group in the US and scheduled for completion in 1992, and in many respects expands and innovates on it.

The system consists of a rule base, a fact base and a valuation tactics base, as well as a rule-base management module, a rule normalization module, a fact-base management module, a query schema management module, a database interface module, and a compiler module.

The system is written in the C language and uses an expanded relational algebra tree (ERA tree) as compilation object code. The compilation process is independent of the database query language, so that the system has excellent portability and universality.

The system's query value optimization tactics embody the latest international research results, using such techniques as demon facilities and a counting approach, which greatly increase its efficiency.

The system has a user-friendly interface, and rule normalization, security checking and optimization methods selection are all done by the system; the system also provides mid-run information display and an explanation of the final answer, which facilitate comprehension. After the system was completed, it was used for more than half a year in real applications, yielding excellent results. The medical diagnosis system developed by a major Shanghai hospital on the basis of this system has given satisfactory operating results. The system is easy to learn and use and has a broad range of applications, including management, scientific research, medicine, industry and many other fields, and it certainly will produce great economic and social benefits.

Integrated Expert System Development Environment

91FE0187C Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 8 Nov 90 p 1

[Article by Shi Jianping [4258 1696 1627] and Yu Xiaohan [0060 1420 2498]: "China's Expert System Development Environment Achieves Major Results"]

[Text] Beijing, 7 November—The Tianma general-purpose integrated expert-system development environment, a major science and technology breakthrough project of the Seventh 5-Year Plan, has now been the subject of joint breakthrough efforts by the CAS Institute of Mathematics, Zhejiang University, Wuhan University, and MMEI, and has now attained a level equivalent to the 1980's state-of-the-art. Breakthroughs have been made in certain areas, and it has successfully promoted Chinese general-purpose integrated expert system development on mainstream computers. The system consists of four inference engines (IEs), three knowledge-acquisition tools, and four sets of human-interface development tools.

Chinese computer experts state that the Tianma environment is the most powerful Chinese-produced expert system development environment and constitutes a pioneering effort; some of its major capabilities have no parallel in similar software encountered on the international market. For example, it has an integrated architecture consisting of four broad-coverage, mutually complementary IEs; it has automated knowledge-acquisition tools based on machine learning and knowledge refinement; and it has a group of automatic interface generating tools that incorporate graphics, windowing, natural language, and menuing. In addition to expert-system knowledge bases, it is also readily usable to develop complete expert systems that include excellent human interfaces. Testing by the Information Sciences Department of China Peoples' University, the Institute of Meteorology, the Central Meteorological Observatory, the Hunan Province Geographic Society and other units also indicates that besides being usable to develop a variety of expert systems, the environment also helps to

identify its own deficiencies and thus to correct them, and that it is well suited for dissemination and will yield economic benefits.

Knowledge Processing Programming System

91FE0187D Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 44, 14 Nov 90 p 1

[Article by Hou Meizhu [0186 2734 4554]: "KPPS Knowledge Processing Program System and KOS Knowledge Operating System Developed"]

[Text] The KPPS knowledge processing programming system and the KOS knowledge operating system, jointly developed by the computer departments of Qinghua University, Nanjing University, and Shanghai Jiaotong University as a key project of the Seventh 5-Year Plan, recently passed its technical evaluation by the computer bureau of MMEI in Beijing.

Computer applications have already advanced from data processing to knowledge and information processing. Knowledge processing systems are a necessary trend in the development of computer systems. The KPPS system, which represents a breakthrough project in knowledge and information processing system components and capabilities, consists of the KPPS/HT-1 knowledge-processing programming system (for distributed knowledge processing), the NEW knowledge programming language, and the GZ knowledge-engineering support software, used in decision-evaluation knowledge-base environments. The experts agreed that the KPPS system design conception is innovative and that the principles and architecture embodied in it are of major importance for further research on knowledge and information processing. The system is in a leading position both domestically and internationally, and the overall level attained by the research topic is already approaching the 1980's world state-of-the-art.

The "ceramics knowledge-base system" developed on the basis of KPPS/TH-1 [sic] system capabilities, has provided a development example for knowledge processing and problem solving in the user sphere and has been highly praised by the users.

The KOS knowledge operating system is an operating system based on knowledge processing; its purpose is to provide an effective, appropriate operating system for a new generation of computer systems, and represents a continuation and development of traditional operating systems. The KOS has the following features.

1. The knowledge communication software system and problem-solving support mechanism, which are oriented toward distributed problems, feature dynamic allocation of knowledge resources and blackboard-based communication between knowledge resources, a tree-oriented decision-making structure, and problem-solving tree

pruning primitives, in a multiuser distributed system with terminal and dialog control and a menued management environment.

2. The intelligent user interface and knowledge-base-oriented operating system offer natural-language (including speech) man-machine interfacing and adaptive distributed task allocation with learning capabilities.

The evaluators concluded that the system architecture is efficient, that the object-oriented distributed blackboard structure and knowledge-based distributed task allocation concepts are innovative, that the intelligent interface uses advanced techniques, that a distinctive distributed terminal I/O control mechanism is used, and that the system development results approach the 1980's world state-of-the-art.

Domestically Made SPARC-Based Workstations on Market

91P60128 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 9 Feb 91 p 1

[Article by Yin Hongqun [1438 1347 5028] and Nie Linhai [5119 2651 3189]: "Reduced-Instruction-Set Computer Workstations Debut"; also see JPRS-CST-91-006, 5 Mar 91 p 25]

[Summary] The China Computer Systems Engineering Company (CCSEC) has announced its development of the state-of-the-art (early nineties-level) Huasheng 4000 series of engineering workstations based on the SPARC

[scalable processor architecture] type of RISC (reduced-instruction-set computing) chip. These new SPARC-based workstations run at 12.5 million instructions per second (MIPS) and 15.8 MIPS, come with high-capacity external and on-board memories, and have exceptionally strong graphics-processing capabilities. At the press conference, the spokesman for CCSEC also announced the construction of a Huasheng Workstation Applications Software Laboratory, which will be open gratis to the public.

IC Reverse-Engineering System Accredited

91P60119 Beijing JISUANJI SHIJE [CHINA COMPUTERWORLD] in Chinese No 5, 30 Jan 91 p 1

[Article by Ming Xia [2494 7209]: "Another New Breakthrough in Integrated-Circuit Reverse Analysis Technology"]

[Summary] The integrated-circuit reverse-analysis (or reverse-engineering) operational system ICRES-II independently developed by the CAS Institute of Automation passed formal technical appraisal on 14 January 1991 in Beijing. This integrated system, with strong image-processing and graphics-processing functions, runs on a 32-bit microcomputer host, and is designed to provide circuit logic diagrams, master drawings, fabrication processes, and fabrication flow charts, especially for increasingly popular ASICs. Various techniques such as knowledge bases, image processing, pattern recognition, software engineering, and computer graphics have been incorporated to realize this "optomechatronically" integrated system.

Guided-Missile/Robotics-Oriented Dynamic Image Tracking System Accredited

91P60121D Beijing RENMIN RIBAO (Overseas edition) in Chinese 13 Feb 91 p 4

[Article by Wang Jin [3769 6210] and Kong Xiaoning [1313 2556 1337]: "Dynamic-Image Visual Tracking & Analysis System Completed"]

[Summary] Beijing, 12 Feb—A "dynamic-image visual tracking/analysis system"—a system which will have wide applications in areas such as missile guidance, military high-altitude reconnaissance, and robot vision (automatic perception and positioning)—passed the CAS-organized academy-level acceptance check today. This key State Seventh 5-Year Plan project, undertaken by the CAS Institute of Automation with the assistance of MMEI, Qinghua University, and Zhejiang University, has resulted in a system which is capable of automatic tracking of both simple and complex scenery; it can track images from any angle of rotation and is highly jam-resistant. Combining dynamic-image-tracking technology with software technology, this system meets late-eighties international standards.

Tunable Picosecond Dye Laser Pumped by Copper Bromide Laser

91FE0224A Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 10, No 10, Oct 90 pp 869-875

[Article by Zhu Lei [2612 7191], Qian Liejia [6929 0441 0502], Zhang Guiyan [1728 2710 3601] and Lin Fucheng [2651 4395 2052] of Shanghai Institute of Optics and Fine Mechanics of the Chinese Academy of Sciences: "Tunable Picosecond Dye Laser Pumped by Copper Bromide Laser"]

[Abstract] In this work, a 25 ns cuprous bromide laser was used to pump a short cavity dye laser at a repetition frequency of 10-20 kHz to produce subnanosecond light pulses. With a certain amount of saturation absorber, the pulse can be further compressed. Under optimal conditions, a 30 ps pulse can be generated, resulting in an overall compression factor of 800. Finally, this short pulse was introduced into an amplifier-dispersion system to make its output reach the Fourier-transform limit pulsewidth.

The experimental apparatus shown in Figure 1 consists of two major parts. The first part is to use a cuprous bromide laser (511 nm) to pump a short cavity dye laser to generate a 30 ps light pulse and the other part is the synchronous amplification and tuning of this pulse. In this work, the effect of the amount of saturation absorber DODCI added to the short cavity on the pulse was studied while the concentration of Rh6G was kept at 5×10^{-3} M/l. It was found that the pulse width decreased

rapidly with increasing DODCI concentration and gradually approaching a constant. When DODCI concentration is 6.6×10^{-5} M/l, the pulse is compressed to (30 + 11) ps.

Based on the theoretical model described in this paper, the pulse width was estimated to be 28 ps. This is in excellent agreement with the experimental value of 30 ps.

This short pulse was synchronously amplified with a dye amplifier-dispersion system and reached Fourier-transform limit. The single pulse energy is 0.15 μ J and spontaneous radiation was suppressed to 10 percent. Its wavelength could be tuned between 570 - 590 nm with a rotating grating. Its line width is 1.0 cm⁻¹. Its repetition frequency is tunable between 10 - 20 kHz.

First Domestic Ground-Probe Radar Developed

91P60121B Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 3 Feb 91 p 3

[Article by Liu Shuen [0491 3219 1869]: "Nation's First Ground-Probe Radar Is Developed by MMEI's Institute 22"]

[Summary] Developed by MMEI's Research Institute 22, the "Model LT-1 ground-probe radar"—the first nation's first such independently developed radar—passed formal technical appraisal a few days ago, at which its performance was judged to be at a mid-eighties international level. A ground-probe radar detects underground phenomena via emission of electromagnetic waves toward an underground area, and then reception of the underground return-wave signal. This shallow-layer underground target-detection technique has important applications in national defense and in the economy. The LT-1 radar consists of two main elements: a radar with a false-color display, and a microprocessor system. The display system incorporates single-board-computer and LSI technologies. Most parts of this reverse-engineered system are built from domestically manufactured devices and components.

Domestic Research on New Laser Crystals, Devices Said To Be State-of-the-Art

91P60121A Beijing GUANGMING RIBAO in Chinese 21 Jan 91 p 1

[Article by Zhou Wenbin [0719 2429 2430]: "Nation's Research on New Laser Crystals, Devices at World's Forefront"]

[Summary] It has been learned from the "New Laser Crystals & Device Technology" conference convened the other day by the Chinese Academy of Sciences (CAS) that the nation's researchers have been responsible for several world-class achievements during the recently concluded Seventh 5-Year-Plan. This is especially true in

the area of inorganic nonlinear optical crystals, where China continues to hold first place worldwide.

In the area of all-solid-state broadband laser systems, Chinese researchers have developed a picosecond-level BBO-crystal [beta barium borate] optical parametric amplifier which puts out coherent light continuously tunable in the 2.63-0.41-micron wavelength range (covering the near-IR through visible bands). Using three BBO crystals, one can obtain a maximum energy-conversion efficiency of over 30 percent, suitable for ultra-short-pulse dye-laser applications. A domestically developed BBO-crystal-based dye-laser UV broad-spectrum system tunable from 410 to 195 nanometers has a maximum signal-frequency efficiency exceeding 30 percent. A Chinese-developed nanosecond-level BBO-crystal-based optical parametric oscillator (OPO) is continuously tunable in the 2.41-0.42-micron wavelength range; this device's energy-conversion efficiency, output energy, and peak power all match the highest values attained for OPOs worldwide.

The domestically developed Nd:YAP (neodymium-doped yttrium aluminum perovskite) crystal has a particularly bright future. CAS researchers have grown high-quality, large-size Nd:YAP crystals with an optical uniformity, optical damage threshold, and other main indicators greatly leading the best values reached in other countries. The CAS scientists have incorporated this crystal into a 188-watt-output-power 1.34-micron-wavelength Nd:YAP continuous-wave (CW) laser, a 424-watt-output-power 1.08-micron-wavelength Nd:YAP CW laser, and a 1.08-micron-wavelength Nd:YAP quasi-CW laser with a maximum average output power of 781 watts; these values are all in the leading position worldwide.

Low-Temperature IR CW Color-Center Laser Developed

91P60121C Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 5 Feb 91 p 2

[Article by Shen Ji [3088 6060]: "Low-Temperature Infrared Continuous Color-Center Laser Developed"]

[Summary] Researchers in the Materials Physics & Chemistry Institute at Overseas Chinese University (OCU) over the past few years have developed a series of doped potassium-chloride (KCl) and sodium-chloride (NaCl) color-center crystal materials that meet advanced international standards. Using these materials, scientists in the Optical-Frequency Research Laboratory at China Institute of Metrology have developed a low-temperature (liquid-N-temperature) vacuum-state color-center laser, a new type of laser that uses a 2-mm-thick crystal as the active medium, operates at a minus 196°C temperature and in a vacuum cavity, and is tunable in the 1-4-micron IR band. In tests conducted from October to December 1990 at OCU, researchers used

two different color-center crystals—Li-doped KCl (2.4-2.75-micron wavelength range) and hydroxyl-group-doped NaCl (1.4-1.8-micron wavelength range)—and achieved stable low-temperature IR CW color-center lasing with each.

Three-Province Forestry Remote-Sensing Survey Yields World's First Dynamic Imagery of Desertification

91P60129 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 7 Feb 91 p 1

[Article by Huang Yong [7806 0516]: "Gansu/Qinghai/Ningxia Comprehensive Forestry Remote-Sensing Survey Yields World's First Dynamic Pictures of Desertification"]

[Summary] Beijing, 6 Feb—In their 4-year project to survey forest resources and desertification in four counties of Gansu, Qinghai, and Ningxia Provinces, scientists from the CAS Lanzhou Desert Research Institute and Beijing Forestry University have conducted leading-edge research in remote-sensing applications, image processing, and information systems. Their research has yielded the world's first dynamic pictures of the desertification process. The researchers employed ratio methods for radiation correction, determination of vegetation cover and growth, and category recognition; over two periods of time, they used MSS [multi-spectral scanner] digital tape to carry out dynamic monitoring of the forests in the rugged loess hills area, where system accuracy reached 75 to 80 percent. The newly produced dynamic remote-sensing images of desertification represent a major advance from the old static imagery.

Investigation on the Pulse Compression of Copper Bromide Laser

91FE0224B Shanghai GUANGXUE XUEBAO [ACTA OPTICA SINICA] in Chinese Vol 10, No 10, Oct 90 pp 876-880

[Article by Zhu Lei [2612 7191], Qian Liejia [6929 0441 0502], Zhang Guiyan [1728 2710 3601], Song Xiudong [1345 4423 0392] and Lin Fucheng [2651 4395 2052] of Shanghai Institute of Optics and Fine Mechanics of the Chinese Academy of Sciences: "Investigation on the Pulse Compression of Copper Bromide Laser"]

[Abstract] For the first time, the 578 nm line of a cuprous bromide laser has been compressed to approach its Fourier-transform limit by injection amplification. Its output characteristics are also investigated. Figure 1 show the schematic diagram of the experiment. The cuprous bromide laser used has a 25 ns pulsewidth and tunable repetition frequency between 10-20 kHz. A mixed dye consisting of Rh6G and a fixed level of saturation absorber DODCI was flowing rapidly between the mirrors to effectively control the pulsewidth within a certain range. A short laser pulse was generated from a short cavity pumped by the 511 nm (green) line of a cuprous bromide laser. This short pulse was then injected into the same cuprous bromide laser to produce a narrow pulse close to Fourier-transform limit at 578

nm (yellow) with an average power of 50 mW. Although $\delta t \delta \nu$ was measured to be 0.8 and the Fourier-transform limit is 0.4 for a rigorous Gaussian curve, it is believed that the experimental result has approached the Fourier-transform limit because the output pulse wave form is no longer pure Gaussian. A theoretical analysis showed that the maximum yellow light output is 65 mW, which is in excellent agreement with the experimental data. This indicated that the particle inversion of the gain medium was fully utilized.

Additional Details on Tungsten-Disk Ar-Ion Laser
91P60124 Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 8 Feb 91 p 1

[Editorial Report] ZHONGGUO DIANZI BAO of 8 February 1991 carries a 200-word article on the Nanjing

Electron Tube Plant's development of the [model A-237] tungsten-disk argon-ion laser, which passed formal technical appraisal in early January 1991. Additional details on this new-generation laser not already given in an earlier report on this topic [see JPRS-CST-91-006, 5 Mar 91 p 22] are provided here. This new state-of-the-art laser, which can be used as a pump source for a dye laser, and as an aid in modern fingerprint-matching technology, consists of a laser tube, a resonator cavity, and a power supply; materials used in its construction are all 100-percent domestically made. The laser tube has a ceramic-metal structure, the resonator has a highly stabilized cavity design, and the power supply is a highly-stabilized-current arc-light dc power supply. Continuous-wave (CW) full-spectrum rated output power exceeds 5 watts, while maximum output power is 7 watts.

Advances in IC Fabrication Reported**GaAs Microwave, Millimeter-Wave ICs From Institute 55**

91P60115A Beijing ZHONGGUO DIANZI BAO
[CHINA ELECTRONICS NEWS] in Chinese
30 Jan 91 p 1

[Article by Song Yuping [1345 3768 1627] and Li Kunkun [2621 2492 2492]: "Gratifying Results Obtained in Domestic Gallium Arsenide Integration Technology"]

[Summary] Chinese researchers have made significant progress in research, design, and fabrication of GaAs microwave and millimeter-wave devices; integration technology has reached the mid-to-late-eighties international level. During the recently concluded Seventh Five-Year Plan, scientists at MMEI's Research Institute 55 made breakthroughs such as the fabrication of drawn 76-mm-diameter and 50-mm-diameter semi-insulating GaAs monocrystal, the realization of 0.3-micron optical lithography, the development of C-band and Ku-band monolithic integrated low-noise amplifiers [a type of MMIC, monolithic microwave integrated circuit], the fabrication of a Ku-band microwave low-noise HEMT, and the development of a CAD software package for design of GaAs ICs. These achievements were formally accredited on 16 January [1991] at an MMEI-sponsored ceremony.

Qinghua University Develops 1 Mbit VLSI ROM

91P60115B Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 1 Feb 91 p 2

[Photo caption by Wang Chengxuan [3769 0701 6693]]

[Text] (XINHUA)—Shown are Qinghua University Microelectronics Institute technical personnel as they carry out dry etching and microscopic inspection of the microfine lines in a VLSI chip. In the inset, upper left, the [newly developed] 1 Mbit Chinese-character-base read-only memory (ROM) is shown with its package. Using two of these 6.4 mm x 6.5 mm VLSI chips, one can store an entire base of almost 7,000 standard Chinese characters and appropriate Chinese and foreign symbols.

More on 1 Mbit VLSI Chinese-Character ROM

91P60115C Beijing BEIJING RIBAO in Chinese
2 Feb 91 p 4

[Article by Wang Chengxuan [3769 0701 6693]: "Scientists, Engineers Develop 1 Mbit Chinese-Character Memory VLSI Circuit"]

[Text] Beijing, 1 Feb (XINHUA)—A 1 Mbit Chinese-character-base ROM VLSI chip with a minimum line width of 1.5 microns and a high degree of integration—it contains 1.06 million transistors—was unveiled the other day at Qinghua University's Microelectronics Institute. This is a breakthrough S&T achievement for



the scientists and engineers working on the nation's first 1-1.5-micron VLSI fabrication line. The 1 Mbit Chinese-character-base ROM chip is a type of ASIC sorely needed domestically; it will have broad applications in various computers and office automation equipment with Chinese-character processing functions, and can completely replace imported chips.

Magnetic-Grid Signal-Processing ASIC

91P60126a Beijing ZHONGGUO DIANZI BAO
[CHINA ELECTRONICS NEWS] in Chinese 8 Feb 91
p 3

[Article by Xiao Yuanzhen [5135 0337 4176]: "Magnetic-Grid Signal Processing Application-Specific Integrated Circuit"]

[Summary] The type SF023 magnetic-grid signal processing ASIC developed by Shanghai Radio Plant No 7 as a key State Seventh 5-Year Plan project passed appraisal the other day in Shanghai. This late-eighties-level LSI chip has wide applications in the domestic electromechanical instruments & meters industry, specifically in the preamplifier stage of the SF6114 magnetic-grid monitoring circuit for various digital-display machine tools.

Fast Multiplier DSP Chip

91P60126b Beijing ZHONGGUO DIANZI BAO
[CHINA ELECTRONICS NEWS] in Chinese 8 Feb 91
p 3

[Article by Wu Ruisheng [0702 3843 3932]: "New Fast Multiplier Passes Appraisal"]

[Summary] A multielement-logic fast numeral multiplier IC—developed by researchers at the CAS Institute of Semiconductors as a special subproject ("66-5-17") of a key State Seventh 5-Year Plan S&T project—passed formal results appraisal the other day in Beijing. Used in scientific calculation and real-time digital signal processing (DSP) applications, this IC has the following characteristics: (1) it has been innovatively designed to be used in domestically developed multielement-logic (DYL-type [discrete Y logic]) linear AND/OR-gate circuits, and overcomes the time delays [i.e., propagation delays] introduced by level inversion in conventional logic circuits; (2) the researchers have used 4-micron MSI technology, with interconnected wiring, to realize a 12 x 12-bit array multiplier whose speed (including wiring delay time) is even faster—almost 100 percent faster—than the maximum speed of VLSI high-speed multipliers now available internationally; (3) the circuit has an active-feed structure, thereby reducing power loss; and (4) it is compatible with the TTL and CMOS logic families.

The experts at the formal appraisal unanimously agreed that this new multiplier chip is at the worldwide state-of-the-art.

National Standards for 'Network-Entry Requirements for Metropolitan Fiber-Optic-Cable Communications Systems'

91FE0112A Beijing DIANXIN JISHU
[TELECOMMUNICATIONS TECHNOLOGY]
in Chinese No 10, Oct 90 pp 37-38

[Article by Wu Baorong [0124 0202 2837] of the S&T Office of the Ministry of Posts and Telecommunications: "National Standards for 'Network-Entry Requirements for Metropolitan Fiber-Optic-Cable Communications Systems'"]

[Text] National Standards for "Network-Entry Requirements for Metropolitan Fiber-Optic-Cable Communications Systems" have been released. The following is a brief summary of the contents.

I. Composition of Optical Cable Communications System and Its Major Transmission Characteristics

1. Assumed Reference Digital Link Circuit (Channel)

The assumed reference digital link circuit length is 100 km, consisting of two 50 km digital segments.

2. System Digital Series for All Transmission Rates

The digital signal bit rate of the system meets specifications stated in Chinese National Standard GB4110-83 "Pulse-Code-Modulated [PCM] Communications System Series."

3. Wavelength Selection

Primarily, the 1,300 nm region is used.

4. Optical Fiber Type

Either single-mode or multimode (graded) optical fiber may be used.

5. Normal Construction of the System and Interface Position

A metropolitan fiber-optic communications system consists of PCM and digital multiplexing equipment and digital fiber-optic-cable circuits. Let us use a DS3 [34 Mb/s, 480 voice circuits] fiber-optic-cable communications system as an example. Figure 1 shows a block diagram of the system in one direction of transmission. (Note: For a DS4 [140 Mb/s, 1,920 voice circuits] metropolitan fiber-optic-cable communications system, the DS4 digital multiplexer M_4 is connected between the optical terminal and the DS3 digital multiplexer M_3 .) The system employs a single-cable, two-way, two-fiber transmission system. Figure 1 also shows various interfacing points.

6. Major Audio-Frequency Transmission Characteristics

The entire range has only a pair of DS1 PCM multiplexers. The major audio-frequency transmission characteristics should meet the specifications in GB-6879-86 ("Technical Requirements for 2,048 kb/s 30-Channel Pulse-Code-Modulation Multiplexing Equipment").

7. System Branching and Interfacing Parameters

The interfacing point of each digital segment is a branching point of a digital signal of a certain rate. During branching, the pulse waveform characteristics, code type, bit rate and its tolerance, input and output protocols, impedance, and attenuation of connecting cable must satisfy the specifications of GB7611-87 ("Digital Interface Parameters for Pulse-Code-Modulation Communications System Network").

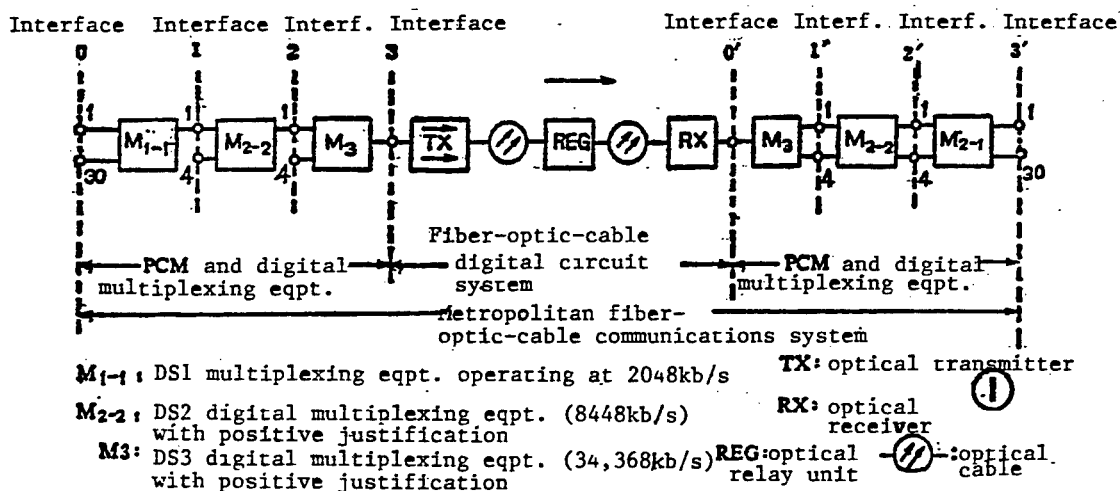


Figure 1

II. Major Transmission Characteristics and Requirements of Digital Fiber-Optic-Cable Circuit System

1. Composition of the Circuit System

The digital fiber-optic-cable circuit system is composed of parts between T' and T in Figure 2. Without relays, it is as shown in Figure 2(a). With a relay, it is as shown in Figure 2(b). The number of relays is determined by system design.

2. System Bit Error Characteristics

Based on the bit error specifications and distribution principle for 64 kb/s transmission over 27,500 km, for a 50-km digital segment of fiber-optic-cable, the bit error characteristics at 64 kb/s should be:

Degradation minute DM ($BER > 10^{-6}$) $\leq 0.2\%$ [BER = bit error rate]

Error second ES $\leq 0.16\%$

Serious error second SES ($BER > 10^{-3}$) $\leq 0.002\%$

The bit error characteristics of a high-bit-rate system are temporarily set to be: $BER \leq 1 \times 10^{-8}$ (no less than 24 hours of continuous testing).

3. System Jitter Characteristics

A digital fiber-optic-cable system should meet the jitter requirement at interfacing points T, T' shown in Figure 2. The maximum gain of jitter transition for each 50-km digital segment should not exceed 1 dB.

The minimum frequency for jitter testing should be kept as low as possible, down to approximately 10 Hz.

4. System Optical Power Distribution

The distribution of optical power is determined by many factors such as the light source, optical detector, fiber-optic-cable attenuation, attenuation at the fiber-optic connectors, and reserve for optic cable and equipment.

5. System Reserve

The reserve for each relay segment for the system without relay shown in Figure 2(a) and the system with relay shown in Figure 2(b) consists of optical cable reserve M_c and equipment reserve M_e . For multimode optical fiber, M_c is 0.3 dB/km. For single-mode optical fiber, M_c is 0.2 dB/km. However, the minimum for each relay segment is 3 dB and maximum is 10 dB. M_e is 3 dB.

6. System Transmission Code Type

The transmission code for a metropolitan digital fiber-optic-cable system is the 5B6B code.

7. Transmitted Optical Power

The mean optical power at connector C's output (S) from an optical transmitter (TX) or from an optical relay (REG) should be as follows:

When the light source is an LD [laser diode], the mean optical power transmitted into a multimode or single-mode optical fiber should not be less than -6 dBm. When the light source is an LED, the mean optical power delivered into a multimode and single-mode optical fiber should not be less than -23 dBm and -28 dBm, respectively.

8. Reception Sensitivity of Optical Receiver and Optical Relay

Reception sensitivity is defined as the lowest optical power received at $BER = 1 \times 10^{-10}$. The lowest average

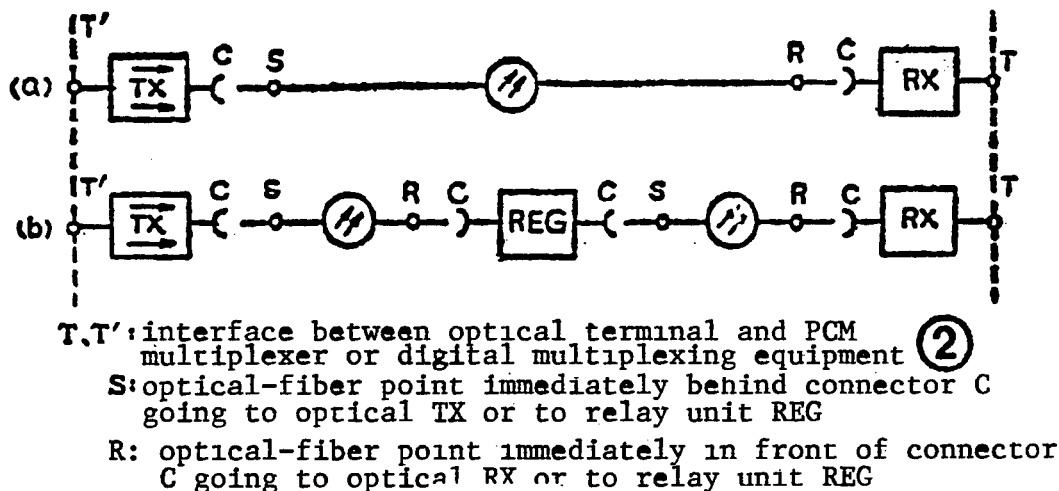


Figure 2

levels of optical power received by an optical receiver RX, or optical relay REG, at the input (point R) of an optical connector C at $BER < 1 \times 10^{-10}$ should not be worse than the following:

When $\lambda = 1,300$ nm, -41 dBm for DS2, -40 dBm for DS3, -40 dBm (APD) or -36 dBm (PIN-FET) for DS4. When $\lambda = 850$ nm, -56 dBm (APD) or -46 dBm (PIN) for DS2 and -50 dBm for DS3. [APD = avalanche photodiode, PIN-FET = positive-intrinsic-negative field-effect transistor photodiode.]

9. Dynamic Range

At an 850-nm wavelength, the dynamic range of the system should be more than 20 dB. At 1,300 nm, the dynamic range of the system should be more than 18 dB.

III. Requirements of Fiber-Optic-Cable Communications System Relative to Equipment and Line

1. Interface Requirements With Various Equipment in the System

Same as "System Branching and Interfacing Parameters" described above.

2. Requirements Relative to PCM and Digital Multiplexing Equipment

Same technical requirements and standards as those for DS1 multiplexers and DS2 and DS3 digital multiplexers.

3. Optical Terminal Requirements

(1) Series: Should be compatible with the 2,048 kb/s series.

(2) Electrical interface: Should meet GB7611-87.

(3) Optical transmitter: Nominal wavelengths of the light source are 850 nm and 1,300 nm. The transmitting code type is 5B6B. The mean transmitted optical power has been described above.

(4) Optical receiver: Reception sensitivity and dynamic range are as described above.

(5) Failure alarms: Sound and light alarms will be generated to signal failures.

4. Requirements on Optical Fiber and Fiber-Optic Cable

(1) Optical fiber used in the fiber-optic cable should have the following characteristics:

a) Fiber dimensions

Multimode optical fiber: core diameter $50 \pm 3 \mu\text{m}$, cladding diameter $125 \pm 3 \mu\text{m}$. Single-mode optical fiber: nominal mode field diameter 9-10 μm , deviation less than 10 percent, cladding diameter $125 \pm 3 \mu\text{m}$.

b) Maximum theoretical numerical aperture (NA)

Multimode optical fiber has a nominal NA value of 0.20 and a tolerance of ± 0.02 .

c) Attenuation constant

This should be less than 4 dB/km at 850 nm and less than 2 dB/km at 1,300 nm for multimode optical fiber. For single-mode optical fiber, it should be less than 0.9 dB/km at 1,300 nm.

d) Bandwidth or overall dispersion

The bandwidth for a multimode fiber should be more than 200 MHzkm at either 850 nm or 1,300 nm. The overall dispersion of a single-mode fiber should not be greater than 3.5 ps/nm-km between 1,285 and 1,330 nm and should not be more than 6 ps/nm-km between 1,270 and 1,340 nm.

e) Cutoff wavelength

The effective cutoff wavelength of the LP_{11} mode of the 1,300-nm single-mode fiber should be 1,100-1,280 nm when measured with a 2-m-long fiber. With a 22-m-long fiber, it should be less than 1,270 nm.

(2) Fiber-Optic-Cable

The nominal cable lengths are 1 km and 2 km. Optical cables should have proper mechanical properties and suitable protection for the application.

IV. Reliability Requirements

(1) The entire 100-km-long system is allowed to have four failures. The reliability data for the 50-km digital segment and optical system, PCM and digital multiplexer are listed in the following table. The system is required to be operational at 99.99 percent.

Table 1

8, 34, 140 Mb/s systems	50-km digital segment (duplex)	Fiber-optic-cable circuit system (duplex)	PCM and digital multiplexing equipment (1-terminal station)
Reliability MTBF	0.5 year	4 years (with a 5:1 primary-to-spare automatic switching ratio)	1.2 years

(2) Light source life: greater than 50,000 hours.

(3) Light detector life: greater than 200,000 hours.

(4) Environmental conditions

Plant: ambient temperature 5-40°C, relative humidity less than 85 percent.

Duct optical cable: -5 to +40°C.

Overhead optical cable: -20°C to +60°C (south of the Huanghe River), or -30 to +50°C (north of the Huanghe

River). Below -30°C , overhead optic-cable is not recommended.

V. Maintenance Requirements

There should be a number of capabilities such as monitoring, alarms, system switching, business communications, internal optoelectronic measurement and switching.

The power-supply voltage is rated at -60 , or -48 , or -24 V, with a 10-percent tolerance. Its voltage pulse should not be more than 5 mV when measured with a noise gauge (less than 2 mV at -24 V).

River Fiber-Optic Cable, Cable Technology Accredited

91P60127 Beijing ZHONGGUO DIANZI BAO [CHINA ELECTRONICS NEWS] in Chinese 10 Feb 91 p 3

[Article by Hu Yidong [5170 0001 2639]: "Three Seventh 5-Year Plan Projects of MMEI's Institute 23 Pass Appraisal"]

[Summary] Three subprojects in the key State Seventh 5-Year Plan project 75-69-02-05 assigned to MMEI's Research Institute 23—river fiber-optic cable, long-length-metal protective-layer Ar-arc-welding contact and streaking technology (used to overcome problems of lateral blowing in dc argon arc welding of magnetic materials), and a study of methods for testing fiber-optic cable machinery characteristics and transmission characteristics—passed the State S&T Commission-sponsored acceptance check the other day, and also passed technical appraisal in Shanghai.

River (or estuary) fiber-optic cable has a structure that includes the loose-packed optical fiber(s), the packing material, and a hermetic seal for the cable itself. This type of cable is designed to be laid on the bottoms of estuaries or rivers and meets mid-eighties international standards.

The research project consists of a "fiber-optic cable machinery performance tester" that meets IEC [International Electrotechnical Commission] standards. It includes the mechanical equipment, an electrical-control and microcomputer system, and an optical power monitoring system (OPMS). This tester can handle up to 16 fiber-optic circuits and has an OPMS with a stability of better than plus or minus 0.05dB after 1 hour of monitoring nine circuits (including two single-mode optical fiber circuits); machine-testing performance meets the Q/YG409-9 technical standard. This tester complies with the National Standard GB-7425 for fiber-optic cable impact, repeated bending, and torsion, as well as with relevant provisions of the IEC794-1 standard and China milspec standards.

Four Beijing P&T Institute Projects in Fiber Optic Communications, Other Areas Accredited

91P60130 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 7 Feb 91 p 2

[Article by Wang Hanlin [3769 5060 2651]: "Nation's Modern Communications Technology Enters New Area"]

[Summary] Four key State Seventh 5-Year Plan projects involved with international telephony, telegraphy, and FAX transmission—projects which mark the nation's entry into new areas of modern communications—recently passed the MPT-organized technical appraisal. Assigned to the Beijing Institute of Posts & Telecommunications, the projects include a "dual long-wavelength wavelength-division multiplexer (WDM)," which will increase optical fiber information transmission capacity, especially for voice-and-image transmission for video-phones; in technical language, this device permits digital/analog hybrid duplex fiber-optic communications. The experimental single-mode-fiber transmission system already built around this technology—the fastest such system in the nation—has performed reliably and stably, with no appearance of cross-talk between channels of different wavelengths.

The other three projects include development of a "GM master-drawing module automatic generation system" for integrated-circuit designers, "communications network terminal equipment," and "subscriber terminal equipment."

Developments in High-Capacity DMW Communications Reported

Equipment Developed at Qinghua University Accredited

91P60122a Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 4 Feb 91 p 2

[Article by Xiao Chen [2556 2525]: "High-Capacity Digital Microwave Communications Equipment Passes Appraisal"]

[Summary] Five key State Seventh 5-Year Plan S&T projects in high-capacity digital microwave (DMW) communications assigned to Qinghua University—including an 11GHz 1920-circuit DMW relay unit, a 140Mbit/s 64-state quadrature amplitude modulation (QAM) system, and an adaptive differential pulse-code modulation (ADPCM) digital terminal—passed appraisal recently in Beijing. This Qinghua University-developed equipment is state-of-the-art, and can completely replace imports.

Equipment Developed by MPT's Institute 4 Accredited

91P60122b Beijing RENMIN RIBAO (Overseas edition)
in Chinese 18 Feb 91 p 1

[Article by Zhang Ruoyu [1728 5387 1946]: "Nation's High-Capacity Digital Microwave Communications Technology and Equipment Enter Advanced International Level"]

[Summary] Xian, 17 Feb (XINHUA)—The high-capacity DMW communications equipment in two key State Seventh 5-Year Plan projects recently completed by MPT's Research Institute 4 indicates that domestic high-capacity DMW technology has reached a mid-to-late-eighties international level. The two projects include development of a 6GHz 1920-circuit DMW communications system and development of point-to-multipoint microwave communications technology and equipment. The 1920-channel system, consisting of 12 subsystems, has an effective relay range of 50 km, suitable for the nation's trunklines. The point-to-multipoint equipment provides 60 channels, sufficient for furnishing 500 subscribers within a 40-km radius with telephone, teletype, FAX, and data transmission services. With repeater stations, the effective range can be extended to several hundred kilometers.

Domestic Production of High-Capacity DMW Systems

91FE0112B Beijing JISUANJI SHIJIE [CHINA
COMPUTERWORLD] in Chinese No 40, 17 Oct 90 p 2

[Article by Xinhua News Agency: "Domestic Production of High-Capacity DMW Systems"]

[Text] The Beijing Communications Equipment Plant (BCEP) of the Ministry of Posts and Telecommunications (MPT) has developed 140 Mbit/s and 2x34 Mbit/s high-capacity digital microwave (DMW) systems and has batch-production capability. The performance of these products has reached a world-class level.

DMW communications is a new technology developed upon digital technology and microwave technology. It is easy to link the signals to modern stored-program-controlled [telephone] exchanges. In addition, this technology has high interference resistance and maintains high fidelity.

BCEP uses NEC technology to manufacture these DMW communications systems. Every second they can transmit the equivalent of 1,920 and 960 digital telephone lines, respectively. The first batch of products has been placed in the Guangxi Autonomous Region. Various technical specifications are either met or exceeded. These systems are praised by the users and Japanese experts.

In China, research into DMW communications technology started in the seventies, and it has been rapidly

developed in the past decade. It is reported that microwave plants under the jurisdiction of the China Posts and Telecommunications Corporation are actively developing DMW communications equipment. New products are being continuously introduced to replace outdated ones. These plants can manufacture DMW equipment for 30, 120, 480, 960 and 1,920 lines, and they are also capable of producing a series of accessories.

High-capacity DMW systems have a wide range of applications. In addition to transmitting telephone messages, they can be used to transmit television programs, telegrams, facsimiles and computer data.

Furthermore, it is our understanding that medium- and small-capacity DMW communications equipment can be made domestically as well. The Xian Microwave Equipment Company developed three microwave communications systems with transmission rates of 2, 8 and 34 Mbit/s, respectively, and eight other types of communications equipment recently accredited by MPT. They are at a 1980's level and are in batch production. These units will replace key microwave communications network in urban areas and improve communications in remote areas.

Iterative Method of Spectral Estimation of Sinusoidal Signals in White-Noise Background

91FE0307A Beijing TONGXIN XUEBAO [JOURNAL
OF CHINA INSTITUTE OF COMMUNICATIONS]
in Chinese Vol 11 No 6, Nov 90 pp 29-33 [MS received
18 Nov 89]

[Article by Men Xiangsheng [7024 0686 2932], Air Force
Telecommunications Engineering Institute]

[Abstract] An iterative method of linear predictive spectral estimation is presented. In this method, white noise is removed according to the power spectrum characteristics of sinusoidal signals. Computer simulation shows that the method leads to high resolution with fewer operands.

In the method presented, the spectrum of sinusoidal signals should have several spectral lines; the spectrum compounded with additive white noise has only a constant added. Starting from the property of noise variance, based on the linear estimation method, the estimation spectrum containing white noise is derived from the Levinson-Durbin algorithm and the ARMA [autoregressive moving average] model. The minimum value of the estimation spectrum is the estimated noise variance, which is derived from the correlation function, thus ensuring that the correlation function matrix is positively defined. After several iterations, a quite precise estimation spectrum can be obtained.

Four figures show comparative results of three estimates, and residual noise variances after deriving the estimated value of noise variance.

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Analysis of Clock-Controlled Sequences

91FE0307B Beijing *TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS]* in Chinese Vol 11 No 6, Nov 90 pp 50-56 [MS received 11 Jul 88]

[Article by Gao Bao'an [6753 1405 1344] of Air Force Telecommunications Engineering Institute, Xian]

[Abstract] The author is an instructor at the Telecommunications Institute; in 1988 he was awarded a master's degree by Xidian University [Xian University of Electronic Science and Technology]. Currently, the author is a doctoral candidate at the Beijing Institute of Posts and Telecommunications.

For cryptological applications, it is highly desirable that the linear complexities of pseudorandom sequences be as large as possible, and that the sequences resist the correlation attack. A new kind of clock-controlled sequences which have the above-mentioned properties is presented. The linear complexity of the sequences is obtained, and the statistical properties of the sequences are discussed. A powerful algorithm for attacking the clock-controlled sequences is obtained.

Two figures show STOP-AND-GO and KMM generators. The author is grateful to his teacher Xiao Guozhen [5618 0948 6966] for guidance and assistance.

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Equivalent-Circuit Parameters of Gap in Suspended Striplines, Applications to Millimeter-Wave Filters

91FE0307C Beijing *TONGXIN XUEBAO [JOURNAL OF CHINA INSTITUTE OF COMMUNICATIONS]* in Chinese Vol 11 No 6, Nov 90 pp 66-70 [MS received 28 Aug 87, revised Aug 88]

[Article by Rong Aosheng [2051 2407 3932] of Southeast University, Nanjing]

[Abstract] The gap in suspended striplines is rigorously analyzed by the transverse resonance method and the two-dimensional spectral-domain approach. A useful family of curves for the equivalent-circuit parameters of the gap is obtained. These curves illustrate the dependency on the operating frequency and strip width and gap length of the suspended stripline. Based on the analytical results, a Ka-band end-coupled bandpass filter

using the suspended stripline is designed. The measured results are in good agreement with the calculated values.

Eight figures show the microgap structure of a suspended stripline, a model pi-equivalent circuit, an equivalent model of resonant cavity, its structure, the equivalent circuit parameters of the gap in a suspended stripline, and the structure and dimensions (as well as the insertion loss feature) of the bandpass filter of the suspended stripline.

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